The Distribution System of the Future - Where We Are Heading

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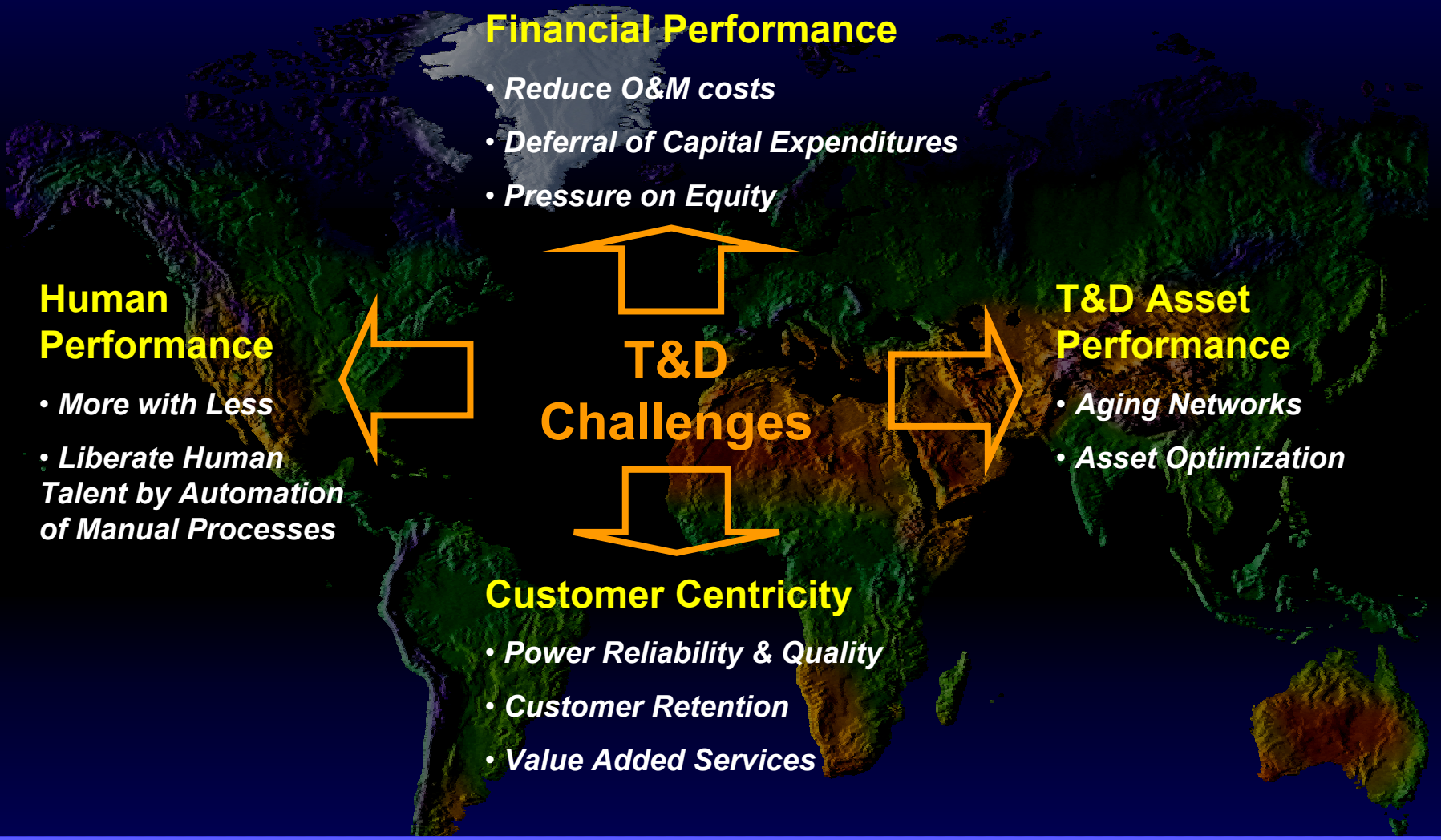
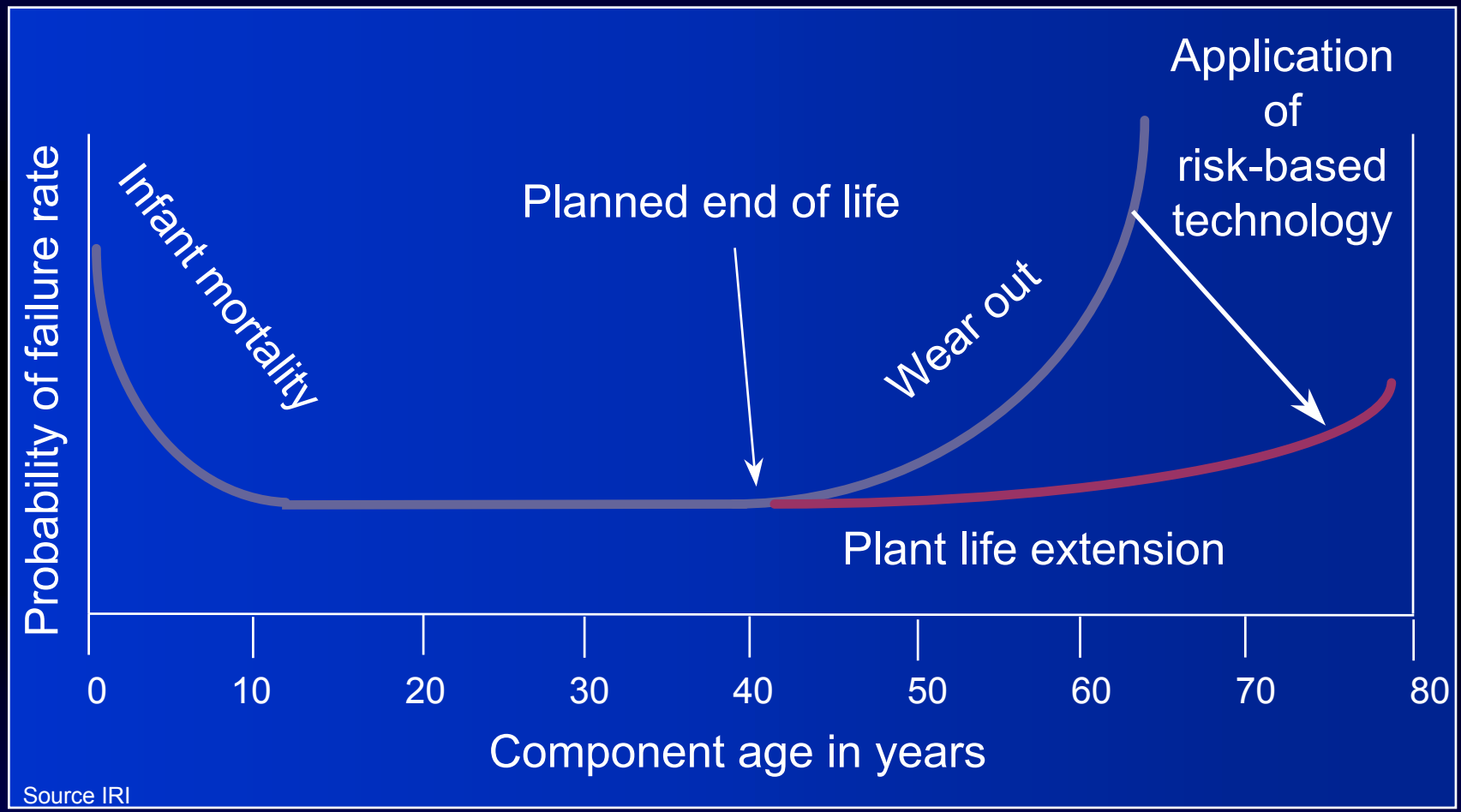
Changing Market for Electric Power Companies



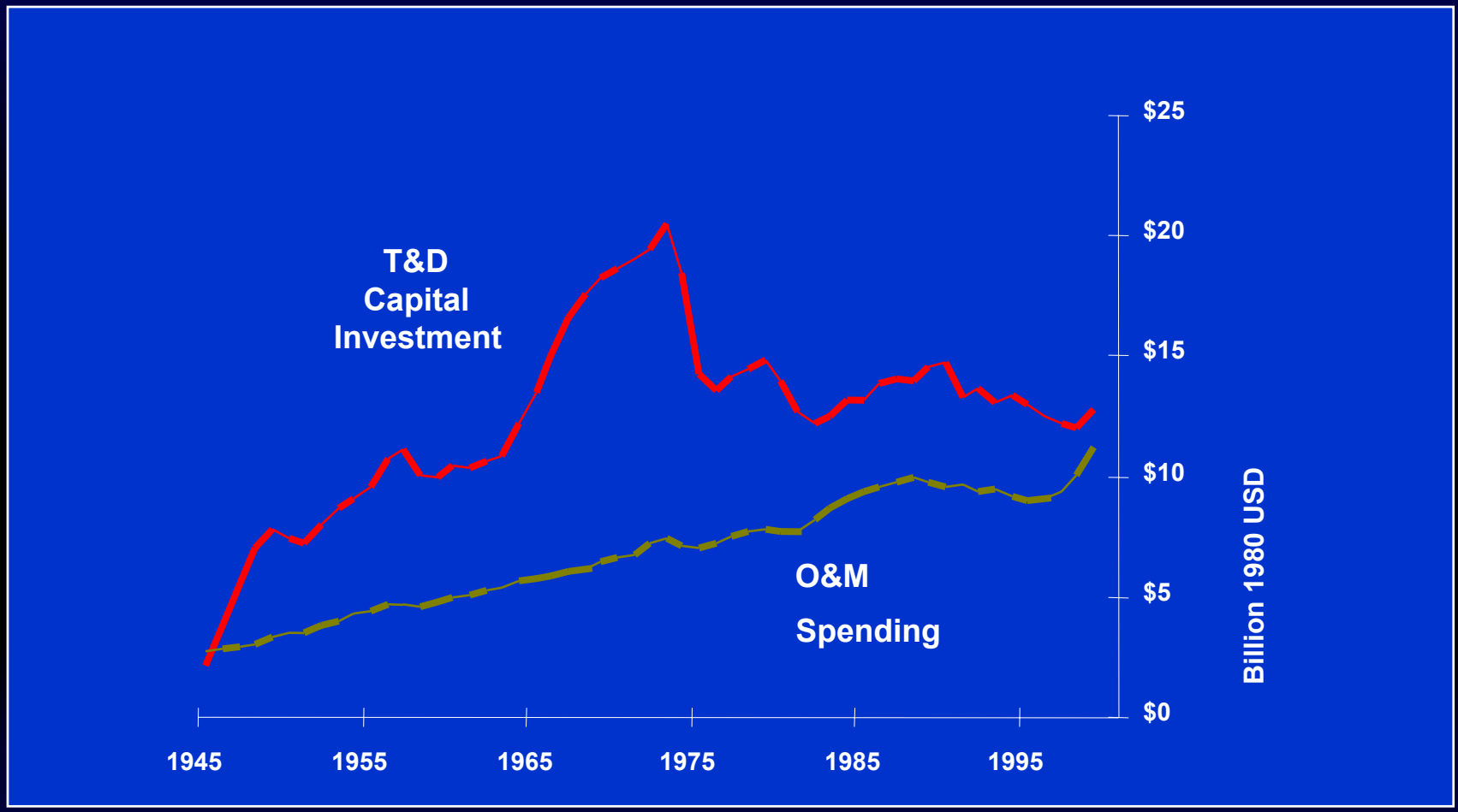
Changing Business Environment … Search for New Options

T&D Asset Life Span



Aging infrastructure isn't going away

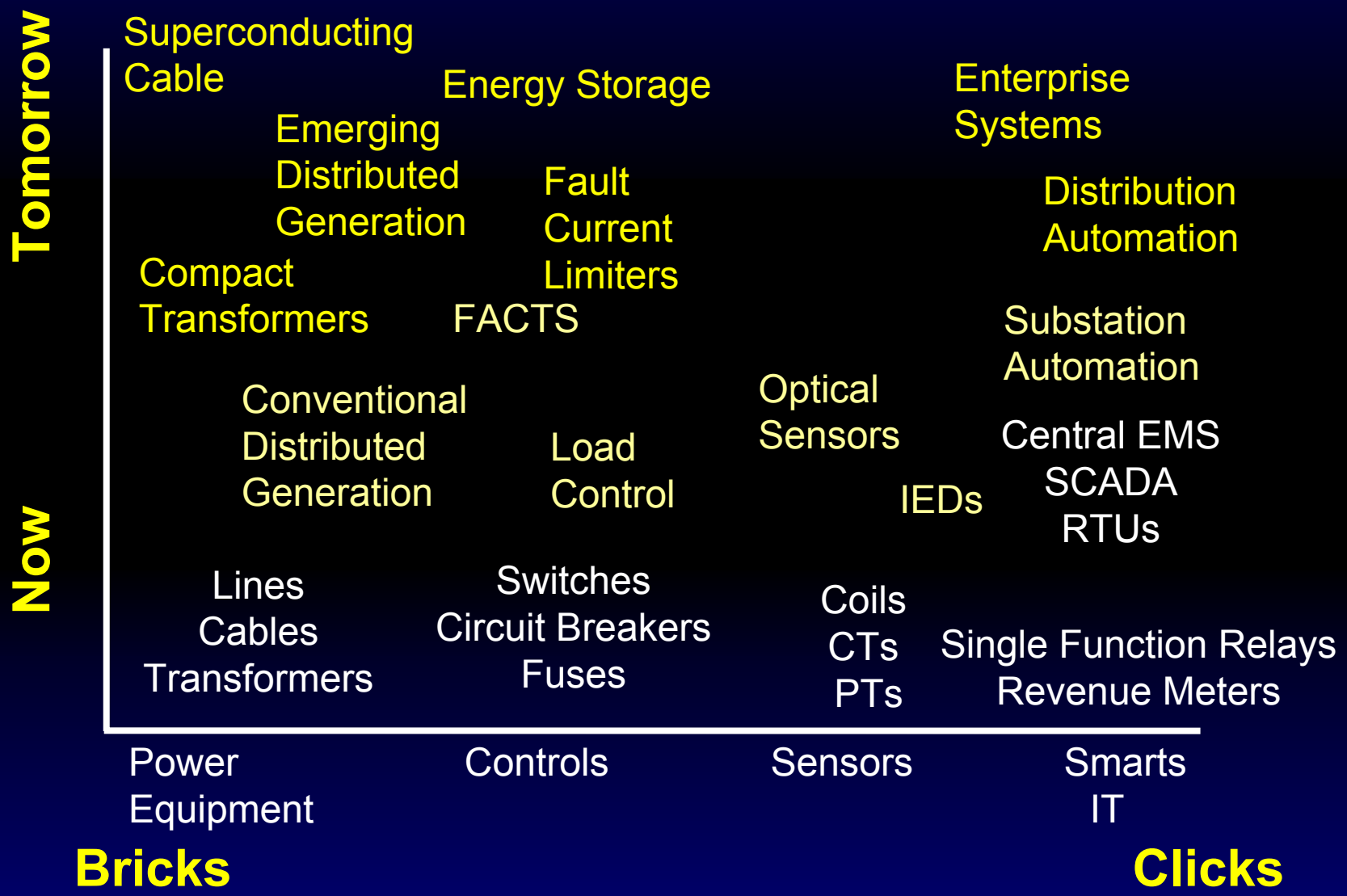
T&D Investments



Source NERC

Asset Base is reaching a Critical Age … 35+ Avg.

Distribution Technology Spectrum



Business Realities Drive Investment

Yesterday

- Dedicated Applications
- Limited systems integration
- Labor intensive Processes

Next …

- GIS Technology … IT backbone
- Enterprise Integration
- Operations Management
- Engineering Management

IT Backbone … for Reliability and Economy

The IT *evolution* has reached substations in a big way

Yesterday

- Discrete Components
- Manned Facilities
- Alarms Only
- Limited Communications

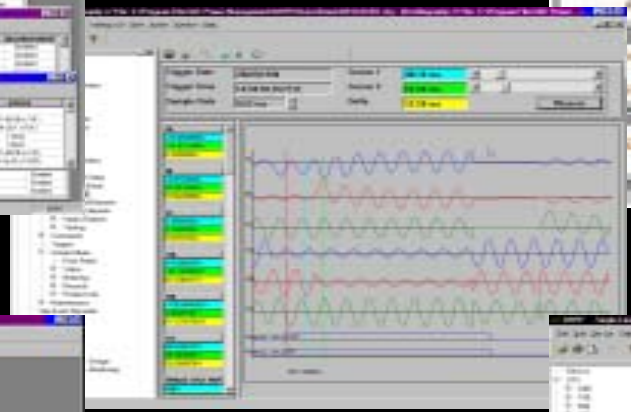
Next …

- IED/Smart Sensor based Architecture
- Remote Access & Control
- Enterprise Connectivity
- High Speed Networks

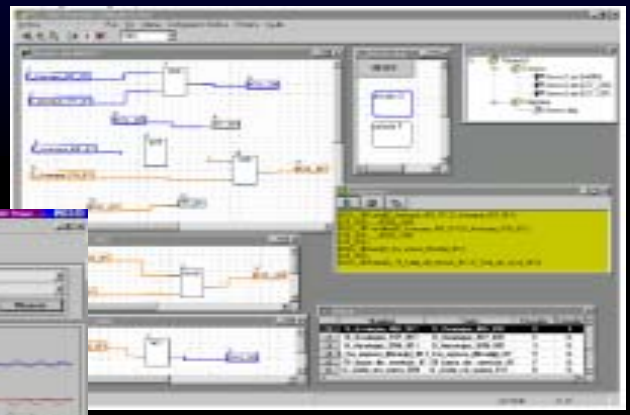
Smart Substation … Reliability and Enterprise

See and control everything in the substation

Settings

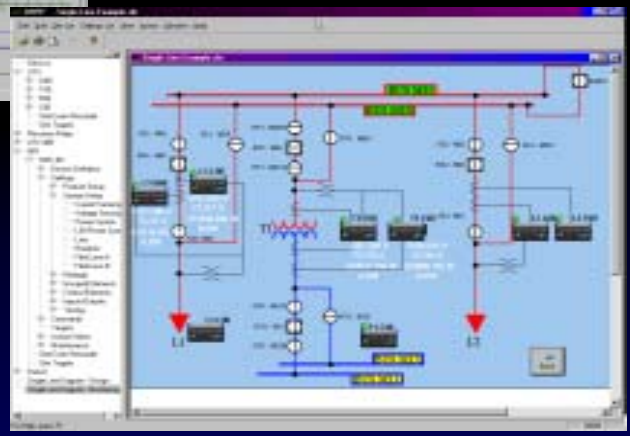


Oscillography



Configuration

Metering



Single-Line Diagrams

Why are utility engineers so conservative?

- Reducing unscheduled outages and failures
- Detecting signs of failure conditions
- Loading T&D equipment for maximum efficiency
- Managing & extending the life of equipment
- Deferring upgrade capital costs
- Taking advantage of spot market opportunity

Reliability, Reliability, Reliability….

Distribution Automation

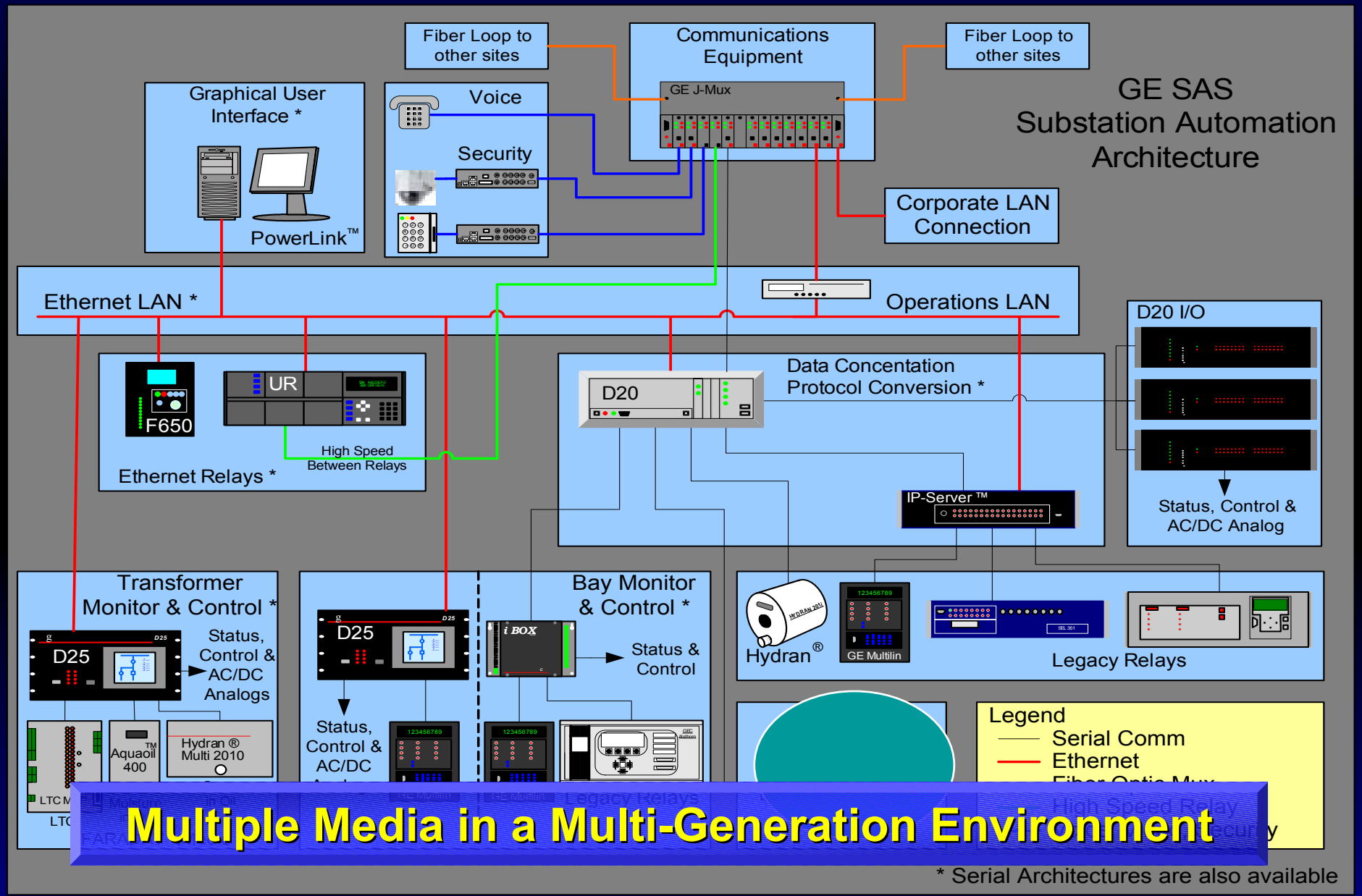
Enabling Technologies Evolving from Central and Substation Automation

Example Applications

- Load Transfer / Bus Restoration Automation
- Fault Localization Automation
- Voltage / VAR Optimization

DA Investments – when there is enough return

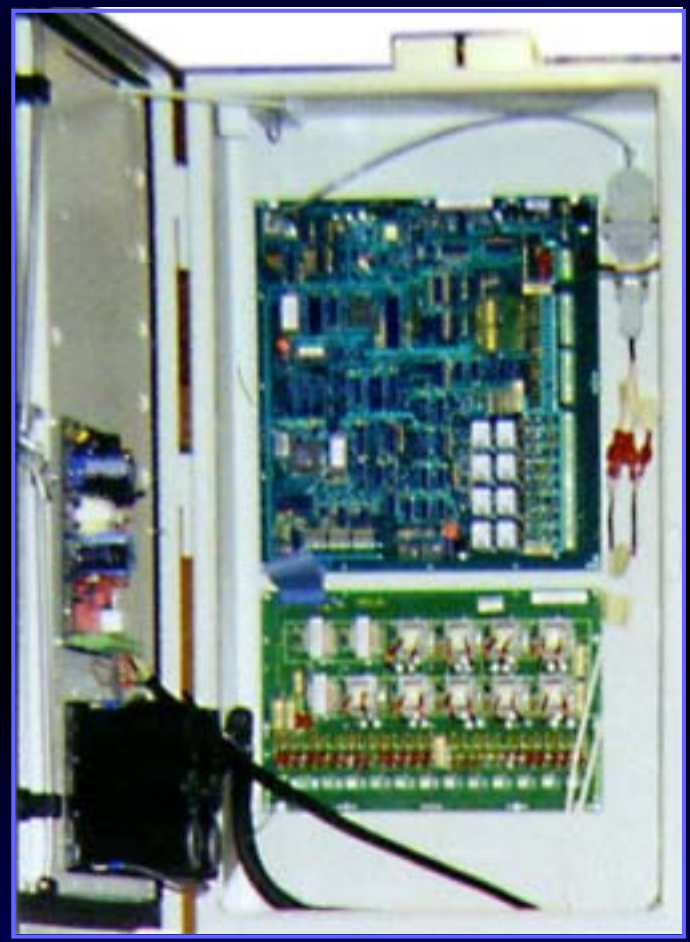
Distribution Automation



High Functionality Smarts – Scaled to Distribution Needs

DART

- Status Inputs
  - 16 Status Inputs
  - 12 or 24 VDC Wetting Voltage
  - SOE 10 MS Resolution
- Control Outputs
  - 8 Discrete Form C Relays
  - Select-Before-Operate Security
  - Local / Remote Switch with LED Indicator
- Analog Inputs
  - Direct Input From CT, PT and Line-Post Sensors
  - 12 AC Inputs
    - » Up to 6 Voltage Inputs
    - » Up to 9 Current Inputs
    - » Optional DC Input
  - Digital Signal Processor Calculates True RMS Current / Voltage, Phase Angle, Current Direction, Watts, VARs, kWh, kVARh, Power Factor



Distribution Automation: a case

Problem

- Risk Cable Damage or Tolerate Long Duration Outages

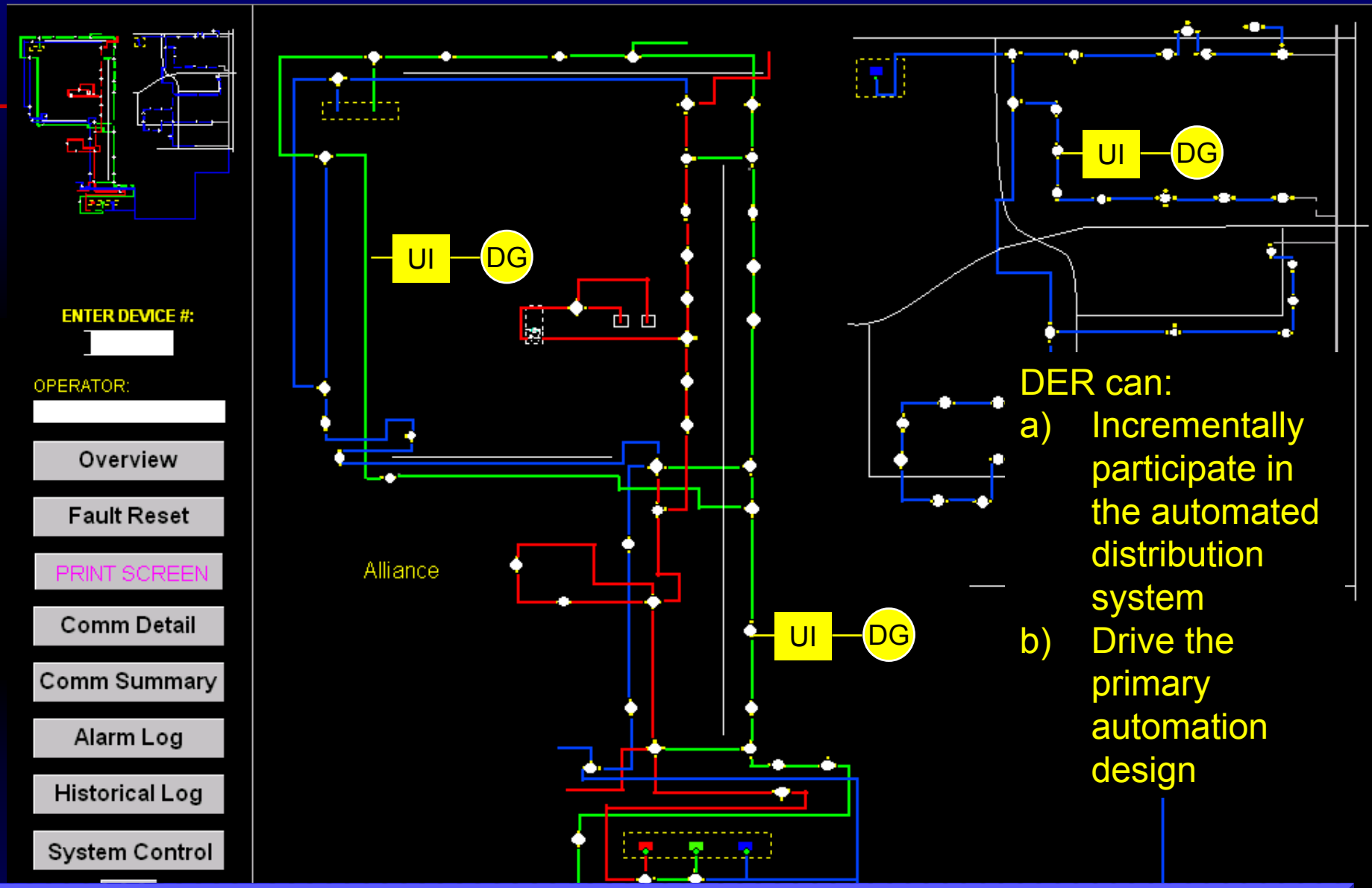
Solution

- New Fault Localization
- Upgraded Existing Equipment
- Advanced Communications Including Ethernet, Fiber, Spread Spectrum Radio, and and Satellite

Primary Benefit

- Reduce Fault Recovery Time From Several Hours to Several Seconds
- Eliminate Potential Damage to Underground Cables From Reclosing

Application where premium reliability justified investment



IT technology can accommodate DER.
Can the business structure?

Summary

1. Current business realities are driving technology – HARD
2. New technologies must provide quantifiable value
3. New technologies must be safe
4. Integrated information technology solutions are critical to success

Distribution System of the Future
has every asset fully utilized for *system* benefits

Where does DER fit in the Distribution System of the Future?

1. Technical evolution of IT to integrate DER is underway
2. The full potential of DER can not be realized unless it is fully integrated with the distribution system (control/protection/automation)
    a. Autonomous operation of DER is limiting
    b. Commercial means to facilitate mutually beneficial performance are needed
3. Barriers are economic, statutory and regulatory: who pays, who owns, who benefits
4. Reliability, reliability, reliability…

Thanks

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